Technical Specifications
Titan

Interacoustics

Item No. 8100759 – ver. 04/2013

General Technical Specification

Titan Hardware – Technical Specifications

Medical CE-mark:	The CE-mark indicates that Interacoustics A/S meets the requirements of Annex II of the Medical Device Directive 93/42/EEC. Approval of the quality system is made by TÜV – identification no0123	
Standards:	**Safety:**	IEC 60601-1, Internally powered, Type B and BF applied parts
	EMC:	IEC 60601-1-2
	Impedance:	IEC 60645-5/ANSI S3.39, Type 1
	Test Signal:	IEC 60645-1/ANSI S3.6 , IEC 60645-3
	OAE:	IEC 60645-6 2009, Type 2 Otoacoustic emissions
	ABR:	IEC 60645-7 2009, Type 2
Cradle	**Safety:** **Power** **Mains voltages and frequencies:** **Consumption:**	IEC 60601-1, Class II Astrodyne ASA30M-0301 or UE24WCP 100 – 240 VAC, 47 – 63 Hz 0.8 – 0.4 A
Battery	**Use only:**	NP120 or CGA103450
Operation environment:	**Temperature:**	15 – 35 °C
	Relative Humidity:	30 – 90%
	Ambient Pressure:	98kPa – 104kPa
	Warm-up Time:	0 seconds
Storing/handling:		Temperatures below 0°C and above 50°C may cause permanent damage to the instrument and its accessories.
Transport:	**Temperature:**	-20 – 50 °C
	Rel. Humidity:	10 – 95%

Impedance Measuring System

Probe tone:	**Frequency:** **Level:**	Classic tympanometry: 226 Hz, 678 Hz, 800 Hz, 1000 Hz; pure tones; AGC controlled to protect for loud probe tone stimuli in small ear canals. WBT: 226 Hz – 8000 Hz broadband stimulus. 226 Hz: 85 dB SPL (≈ 69 dB HL) WBT: 96 dB peSPL (infant) / 100 dB peSPL (adult). (100 dB peSPL ≈ 65 dB nHL)
Air pressure:	**Control:** **Indicator:** **Range:** **Pressure limitation:** **Pressure change rate:**	Automatic. Measured value is displayed on the graphical display. -600 to +300 daPa. -750 daPa and +550 daPa. Minimum, medium, maximum or automatic with minimum speed at compliance peak. Selectable in the setup.
Compliance:	**Range:**	0.1 to 8.0 ml at 226 Hz probe tone (Ear volume: 0.1 to 8.0 ml) and 0.1 to 15 mmho at 678, 800 and 1000 Hz probe tone.
Test types:	**Tympanometry**	Automatic, where the start and stop pressure can be user-programmed in the setup function. Manual control of all functions.
	Eustachian tube function 1 – Non perforated eardrum	Williams test
	Eustachian tube function 2 – Perforated eardrum	Toynbee test
	Eustachian tube function 3 – Patulous Eustachian tube	Continuous sensitive impedance measurement for 30 up to 150 s.
Indicators:	**Graphical display**	Compliance is indicated as ml and pressure as daPa. In PC controlled mode admittance, susceptance and conductance can be printed. Stimulus level is indicated as dB Hearing Level.
Memory:	**Tympanometry:**	1 curve per ear per tympanometry test. 3 curves per ear per

		Eustachian tube function test. And theoretically an infinite number of tests per protocol.
There is no deviation between static and dynamic mode.		
Reflex Functions		
Signal sources:	**Tone - Contra, Reflex:**	250, 500, 1000, 2000, 3000, 4000, 6000, 8000 Hz.
	Tone - Ipsi, Reflex:	500, 1000, 2000, 3000, 4000 Hz.
	NB noise - Contra, Reflex:	250, 500, 1000, 2000, 3000, 4000, 6000, 8000 Hz.
	NB noise - Ipsi, Reflex:	1000, 2000, 3000, 4000 Hz.
	Noise - Contra, Reflex:	Wide Band, High Pass, Low Pass.
	Noise - Ipsi, Reflex:	Wide Band, High Pass, Low Pass.
Outputs:	**Contra Earphone:**	TDH39 earphone, DD45 earphone, CIR55 insert and/or EARtone 3A insert for Reflex measurements.
	Ipsi Earphone:	Probe earphone incorporated in the probe system for Reflex measurements.
	Air:	Connection of the air system to the probe.
Test types:	**Manual Reflex**	Manual control of all functions.
	Automated Reflex	Automatic reflexes: - Single intensities - Reflex growth
	Reflex Decay	Automatic, 10 dB above threshold and manually controlled with stimulus durations of 10 to 30 s.
	Reflex latency	Automated, first 300 ms from stimulus start.

ABR Infant Screening		
Preamplifier	**One Channel:**	3 electrodes. 50 cm Switchable: Software will automatically switch mastoid and ground if mastoid montage is used. So the user does not need to replace electrode during testing.
	Gain:	64 dB
	Frequency response:	0,5 - 5000 Hz
	Noise:	<25 nV/√Hz
	CMR Ratio:	>90 dB.
	Max input offset voltage:	2.5 V
	Input impedance:	10 MΩ/ 170 pF
	Power from main unit:	Isolated power supply
Electrical Impedance measurement	**Measurement frequency:**	33 Hz
	Waveform:	Rectangular
	Measurement current:	11.25 µA
	Range:	0.5 kΩ – 25 kΩ ± 10 %
Stimulus	**Stimuli:**	Click range (200 Hz -11 kHz) CE-Chirp® range (200 Hz – 11 kHz) HiLo CE-Chirp® range (Lo – up to 1.5 kHz) & (Hi – above 1.5 kHz)
	Stimulus rate:	90 Hz
	Transducers: **(Calibrated to Standards)**	EARTone ABR insert phone EARTone ABR for EarCup TDH 39 or DD45 head phone (Static force: 4,5N ± 0,5N IOW Probe
	Channels:	2
	Level:	30 dB nHL, 35 dB nHL, 40 dB nHL
	Bandwidth:	22.05 kHz
Recording	**Analysis time:**	1-10 min or Residual noise 5-80 nV
	A/D resolution:	24 bit
	Artifact reject system:	Rejection level (Peak, Min RMS, Max RMS) & Clipping (Saturation)
Display		Stimulus level and type, Bar and Graph view
		Basic and advanced view
Algorithmic Sensitivity	**CE-Chirp:**	99.9%
Algorithmic Specificity	**CE-Chirp:**	> 96%

DPOAE		
Stimulus	**Frequency range:**	500 to 10000 Hz
	Nominal frequency:	f2
	Frequency step:	25 Hz
	Level:	30 to 80 dB SPL (75 dB SPL for 6kHz and 65 dB SPL for 8kHz to 10kHz)
	Level Step:	1 dB
	Transducer:	IOW Probe auto detection, auto calibrated
Recording	**Analysis time:**	Minimum 2 seconds to unlimited time
	A/D Resolution:	24 bit, 5.38 Hz resolution
	Artifact rejection system:	-30 to +30 dB SPL or off
	Stimulus tolerance:	Adjustable between 1 and 10 dB
	SNR criteria:	Adjustable between 3 and 25 dB
	Probe check window:	256 points frequency response of the ear canal due to a click stimulus.
	DP-response window:	4096 points frequency response
	Residual noise:	A RMS average measurement in the DP-bin frequency area (26 bins at frequencies < 2500 Hz & 60 bins ≥ 2500 Hz).
Display	**General display gain:**	Applicable during testing
	Display:	Stimulus level and type, Bar and Graph view
Probe specifications	**Titan IOW probe:**	IMP, DPOAE, TEOAE and ABRIS capable
		Replaceable probe tip
Other		
Test Pressure:		Ambient pressure. Tympanic peak pressure.

TEOAE		
Stimulus	**Frequency range:**	500 to 5500 Hz
	Frequency step:	1 Hz (Custom bands)
	Stimulus type:	Non-Linear and Linear (according to IEC 60645-3)
	Level:	30 to 90 dB peSPL, peak to peak calibrated, AGC controlled
	Level step:	1 dB
	Click rate:	43 – 100 Hz
	Stimulus tolerance:	Adjustable between 1 and 3 dB
	Transducer:	IOW Probe auto detection, auto calibrated
Recording	**Analysis time:**	1 second to unlimited time
	A/D Resolution:	24 bit
	Artifact rejection system:	0 to +60 dB SPL or off
	SNR criteria:	Adjustable between 5 and 25 dB
	TE criteria:	Band SNR, No. of Sweeps, Test time, Min Total OAE, Min Reproducibility - adjustable for use as test criteria
Display	**Stimulus time window:**	128 points instant recording of first click in sequence of clicks
	Probe check window:	256 points frequency response of the ear canal recorded click stimulus
	Time recording window:	3 – 23 msec (max). A and B buffer time-samples @ sampling rate 11025 Hz
	Wave reproducibility window:	Adjustable inside the recording window
	Freq. response window:	256 points frequency response, bin spacing 43 Hz
	Other information:	In ear status (active during test), Noise level, Tympanic peak pressure
		Basic and Advanced view, FFT view, Test Summary view
Probe specifications	**Titan IOW probe:**	IMP, DPOAE TEOAE and ABRIS capable
		Replaceable probe tip
Other		
Test Pressure:		Ambient pressure or tympanic peak pressure found in IMP module

General		
PC control:	**USB:**	Input/output for computer communication. Titan can be fully operated from a PC. The measurements can then be followed on the PC screen. Data can be sent to and saved on the PC and stored in OtoAccess™. See separate section in Service Manual for programming details.
Memory:		Theoretically, an infinite amount of test results can be stored on the PC. The Titan hand held unit is delivered with a 1 GB memory card, enough for storing more than a quarter of a million tests.
Thermal printer (Optional):	**Type:**	Thermal (Bluetooth) printer with recording paper in rolls. Print on command through Bluetooth communication and through serial RS-232.
	Paper width:	57.5 ± 0.5 mm on thermal printer
	Printing time:	Printing time depends on the size of the used protocol. For 2 tympanograms and 8 reflexes the thermal printer uses approximately 6s.
Dimensions		6 x 6 x 28 cm / 2.4 x2.4 x11 inches
Titan Weight		360 g / 0.8 lbs
ABR/OAE/IMP PreAmp shoulder box weight		120 g / 0.26 lbs
ABR/OAE/IMP PreAmp shoulder box Dimensions		10.2 x 6.8 x 2.6 cm / 4 x 2.7 x 1 inches
OAE/IMP shoulder box weight		64 g / 0.14lbs
OAE/IMP shoulder box Dimensions		6.5 x 3.5 x 1.8 cm / 2.6 x 1.4 x 0.7 inches

Table 1: Frequencies and Intensity Ranges for IMP440

Titan Maximums IMP										
	TDH39		*CIR55*		*EARtone 3A*		*IOW IPSI*		*DD45*	
Center	*Reading*		*Reading*		*Reading*		*Reading*		*Reading*	
Freq. [Hz]	*Tone [dB HL]*	*NB [dB HL]*	*Tone [dB HL]*	*NB [dB HL]*	*Tone [dB HL]*	*NB [dB HL]*	*Tone [dB HL]*	*NB [dB HL]*	*Tone [dB HL]*	*NB [dB HL]*
125	80	65	85	70	100	85	70	60	80	65
250	100	85	100	85	110	100	85	75	100	85
500	120	100	110	100	115	105	100	85	115	100
750	120	105	110	105	120	110	100	85	120	105
1000	120	105	115	105	120	110	105	90	120	105
1500	120	105	115	105	120	110	110	90	115	100
2000	120	105	115	105	120	110	105	90	115	100
3000	120	105	115	105	120	110	95	90	125	105
4000	120	105	110	100	120	105	100	85	115	105
6000	120	100	95	95	105	100	85	80	110	90
8000	105	95	80	85	90	85	80	75	105	95
10000										
WB	-	120	-	120	-	120	-	105	-	125
LP	-	120	-	120	-	120	-	110	-	120
HP	-	120	-	120	-	120	-	105	-	130

Table 2: Frequencies and Intensity Ranges for DPOAE440

Titan Maximums DPOAE		
	IOW IPSI	*IOW ch2*
	Reading	*Reading*
Center Freq. [Hz]	*Tone [dB SPL]*	*Tone [dB SPL]*
500	80	80
750	80	80
1000	80	80
1500	80	80
2000	80	80
3000	80	80
4000	80	80
6000	75	75
8000	65	65
10000	65	65

Titan Maximums TEOAE

Maximum TEOAE Click Intensity: 90 dB peSPL

Titan Maximums ABRIS

Maximum ABRIS levels for Click and CE-Chirp stimuli are limited to 30, 35 & 40 dBnHL for all transducers.

Specification of input/output connections

Inputs	**Connector type**	**Electrical properties**	
Patient response	Jack, 3,5mm 4-pole	Handheld switch: Pin 1: GND Pin 2: Signal Pin 3: Future use I/O Pin 4: Future use I/O	3V through 10K Ω is forced to ground when activated
Outputs:			
Phones, Left/ Right	Jack, 3,5mm 4-pole	Voltage: Min. load impedance: Pin 1: CH1 GND Pin 2: CH1 OUT (left) Pin 3: CH2 OUT (right) Pin 4: CH1 GND	Up to 3V rms. by 10Ω load 8Ω Pin 3:
Phones, Contralateral	Jack, 3,5mm 4-pole	Voltage: Min. load impedance: Pin 1: CH1 GND Pin 2: CH1 OUT (left) Pin 3: CH2 OUT (right) Pin 4: CH1 GND	Up to 3V rms. by 10Ω load 8Ω
Transducer	IA proprietary, 12-pole	Pin 1: Pin 2: Pin 3: Pin 4: Pin 5: Pin 6: Pin 7: Pin 8: Pin 9: Pin 10: Pin 11: Pin 12:	CH1 out CH1 GND DGND GND A / GND Microphone Microphone – input / Analog balanced in Microphone + input / Analog balanced in Power supply +3/+5V CH2 out CH2 GND I2C CLK I2C DATA I2C Interrupt
Data I/O:			
USB	USB type"B"	USB port for communication	

Calibration Properties

Calibrated Transducers:	Contralateral Earphone:	Telephonics TDH39 with a static force of 4.5N ±0.5N and/or EARtone 3A and/or CIR55 insert phone
	Probe system:	Ipsilateral Earphone: is integrated in the probe system Probe frequency transmitter and receiver and pressure transducer is integrated in the probe system
Accuracy:	General	Generally the instrument is made and calibrated to be within and better than the tolerances required in the specified standards:
	Reflex Frequencies:	±1%
	Contralateral Reflex and Audiometer Tone Levels:	±3 dB for 250 to 4000Hz and ±5 dB for 6000 to 8000Hz
	Ipsilateral Reflex Tone Levels:	±5 dB for 500 to 2000Hz and +5/-10 dB for 3000 to 4000Hz
	DPOAE Levels:	±1.5 dB for 1000 to 4000Hz and ±3 dB outside range
	Pressure measurement :	±5% or ±10 daPa, whichever is greater
	Compliance measurement:	±5% or ±0.1 ml, whichever is greater

Impedance Calibration Properties

Probe tone	Frequencies:	226 Hz ± 1%, 678 Hz ± 1%, 800 Hz ± 1%, 1000 Hz ± 1%
	Level:	85 dB SPL ±1.5 dB measured in an IEC 60318-5 acoustic coupler. The level is constant for all volumes in the measurement range.
	Distortion:	Max 1% THD
Compliance	Range:	0.1 to 8.0 ml
	Temperature dependence:	-0.003 ml/°C
	Pressure dependence:	-0.00020 ml/daPa
	Reflex sensitivity:	0.001 ml is the lowest detectable volume change
	Temporal reflex characteristics:	Initial latency = 35 ms (±5 ms) Rise time = 45 ms (±5 ms) Terminal latency = 35 ms (±5 ms) Fall time = 45 ms (±5 ms) Overshoot = max. 1% Undershoot = max 1%
Pressure	Range:	Values between -600 to +300 daPa can be selected in the setup.
	Safety limits:	-750 daPa and +550 daPa, ±50 daPa

Reflex Calibration Standards and Spectral Properties:

General	Specifications for stimulus and audiometer signals are made to follow IEC 60645-5	
Contralateral Earphone	Pure tone:	ISO 389-1 for TDH39 and ISO 389-2 for CIR 55.
	Wide Band noise (WB):	Interacoustics Standard
	– Spectral properties:	As “Broad band noise” specified in IEC 60645-5, but with 500 Hz as lower cut-off frequency.
	Low Pass noise (LP):	Interacoustics Standard
	– Spectral properties:	Uniform from 500 Hz to 1600 Hz, ±5 dB re. 1000 Hz level
	High Pass noise (HP):	Interacoustics Standard
	– Spectral properties:	Uniform from 1600 Hz to 10KHz, ±5 dB re. 1000 Hz level
Ipsilateral Earphone	Pure tone:	Interacoustics Standard.
	Wide Band noise (WB):	Interacoustics Standard
	– Spectral properties:	As “Broad band noise” specified in IEC 60645-5, but with 500 Hz as lower cut-off frequency.
	Low Pass noise (LP):	Interacoustics Standard
	– Spectral properties:	Uniform from 500 Hz to 1600 Hz, ±10 dB re. 1000 Hz level
	High Pass noise (HP):	Interacoustics Standard
	– Spectral properties:	Uniform from 1600 Hz to 4000 Hz, ±10 dB re. 1000 Hz level
	General about levels:	The actual sound pressure level at the eardrum will depend on the volume of the ear. See Table 2 for details.

The risk of artifacts at higher stimulus levels in reflex measurements are minor and will not activate the reflex detection system

Table 3: Reference Values for Stimulus Calibration

	Freq.	Reference values for stimulus calibration [dB re. 20 µPa]							Variation of Ipsi stimulus levels for different volumes of the ear canal Relative to the calibration performed on an IEC 126 coupler [dB]		Sound attenuation values for TDH39 earphones using MX41/AR or PN51 cushion [dB]
		ISO 389-1 **(Interacoustics Standard)**	ISO 389-2 **(Interacoustics Standard)**	ISO 382-2 **(Interacoustics Standard)**	**Interacoustics Standard**	**Interacoustics Standard**	**Interacoustics Standard**	**ISO 389-4 (ISO 8798)**	**0.5 ml**	**1 ml**	
	[Hz]	TDH39	EARtone 3A / ABR	CIR55	DD45	IOW Probe	**IOW Probe NB**	**NB Stimulus Correction Values** (except IOW probe)			
RETSPL	125	45	26	26	**47.5**	**41**	**43.5**	4			3
	250	25.5	14	14	**27**	**24.5**	**26.5**	4			5
	500	11.5	5.5	5.5	**13**	**9.5**	**17**	4	9.7	5.3	7
	1000	7	0	0	**6**	**6.5**	**10.5**	6	9.7	5.3	15
	1500	6.5	2	2	**8**	**5**	**12**	6			21 (1600 Hz)
	2000	9	3	3	**8**	**12**	**11**	6	11.7	3.9	26
	3000	10	3.5	3.5	**8**	**11**	**11**	6	-0.8	-0.5	31 (3150 Hz)
	4000	9.5	5.5	5.5	**9**	**3.5**	**8**	5	-1.6	-0.8	32
	6000	15.5	2	2	**20.5**	**3**	**5.5**	5			26 (6300 Hz)
	8000	13	0	0	**12**	**-5**	**-0.5**	5			24
	WB	**-8**	**-5**	**-5**	**-8**	**-5**			7.5	3.2	
	LP	**-6**	**-7**	**-7**	**-6**	**-7**			8.0	3.6	
	HP	**-10**	**-8**	**-8**	**-10**	**-8**			3.9	1.4	
neRETSPL	CE-Chirp	**27.5**	**31.5**		**26**	**32**					
	CE-Low Chirp	**26.5**	**26.5**		**25.5**	**27.5**					
	CE-High Chirp	**28**	**31**		**28**	**32**					
	Click	**30.5**	**35**		**32.5**	**28**					

All figures in bold are Interacoustics Standard values.

Coupler Types used by Calibration

IMP:
TDH39 is calibrated using a 6cc acoustic coupler made in accordance to IEC 60318-3, Ipsilateral earphone and probe tone are calibrated using a 2cc acoustic coupler made in accordance to IEC 60318-5
ABRIS:
Probe and insert stimuli are calibrated in SPL values using an ear simulator coupler made in accordance to IEC 60318-4. Headphones (TDH39 and DD45) stimuli are calibrated in SPL values using an artificial ear coupler according to IEC 60318-1.
DPOAE:
Probe stimuli L1 and L2 are calibrated in SPL values using an ear simulator coupler made in accordance to IEC 60318-4.
TEOAE:
Probe stimuli are calibrated in peSPL values using an ear simulator coupler made in accordance to IEC 60318-4.

General about Specifications

Interacoustics continuously strives to improve its products and their performance. Therefore the specifications can be subject to change without notice.
The performance and specifications of the instrument can only be guaranteed if it is subject to a technical maintenance at least once a year. This should be carried out by a workshop authorized by Interacoustics.

Interacoustics puts diagrams and service manuals at the disposal of authorized service companies.

Enquiries about representatives and products may be sent to:

Interacoustics A/S	Phone:	+45 63713555
Drejervaenget 8	Fax:	+45 63713522
DK 5610 Assens	E-mail:	info@interacoustics.com
Denmark	http:	www.interacoustics.com

Included and Optional Parts

IMP440
Included parts:
Titan handheld unit with basic probe
Power supply (with converter)
BET55 Ear tips and box
Lithium Battery
4 cavities (0.2, 0.5, 2 and 5cc)
Titan PC suite with IMP440
Instructions for Use
TCB Carrying Bag

Included parts with diagnostic & clinical versions:
Cradle
Clinical probe extension
CIR55 contra insert headset
OtoAccess™ database

Optional parts:
Short probe extension
Thermal printer AB1310/AB1310 Bluetooth
DD45C contra cup headset
EARtone 3A insert headset for contra
Cradle
Clinical probe extension
OtoAccess™ database
WBT calibration kit

DPOAE440
Included parts:
Titan handheld unit with basic probe
Cradle
Power supply (with converter)
Clinical probe extension
BET55 Ear tips and box
Lithium Battery
4 cavities (0.2, 0.5, 2 and 5cc)
Titan PC suite with DPOAE440
OtoAccess™ database
USB cable, USB adaptor
Instructions for Use
TCB Carrying Bag

Included parts with screener version:
Eartip 3-5mm flanged (25 pcs.)
Eartip 4-7mm flanged (25 pcs.)
Eartip 5-8mm flanged (25 pcs.)

Optional parts:
Short probe extension
Thermal printer AB1310/AB1310 Bluetooth

ABRIS440
Included parts:
Titan handheld unit with basic probe
Cradle
Power supply (with converter)
PreAmplifier w/clothing clip & neckstrap
Montage stickers
Short extension cable
ETSE tab surface electrode cables
Pinch style electrode cables
Sanibel tab surface electrodes (36 pcs.)
Sanibel snap surface electrodes (36 pcs.)
SPG15 preparation gel
Alcohol pads, Gauze swabs
USB cable, USB adaptor
BET55 Ear tips and box
Eartip 3-5mm flanged (25 pcs.)
Eartip 4-7mm flanged (25 pcs.)
Eartip 5-8mm flanged (25 pcs.)

Lithium Battery
4 cavities (0.2, 0.5, 2 and 5cc)
Titan PC suite with ABRIS440
OtoAccess™ database
Instructions for Use
TCB Carrying Bag

Optional parts:
EARtone ABR stereo ID earphones
EarTone EarCup stereo ID transducer
Thermal printer AB1310/AB1310 Bluetooth
TDH39 Stereo ID headset
DD45 stereo ID headset

TEOAE440
Included parts:
Titan handheld unit with basic probe
Cradle
Power supply (with converter)
Clinical probe extension
BET55 Ear tips and box
Lithium Battery
4 cavities (0.2, 0.5, 2 and 5cc)
Titan PC suite with DPOAE440
OtoAccess™ database
USB cable, USB adaptor
Instructions for Use
TCB Carrying Bag

Included parts with screener version:
Eartip 3-5mm flanged (25 pcs.)
Eartip 4-7mm flanged (25 pcs.)
Eartip 5-8mm flanged (25 pcs.)

Optional parts:
Short probe extension
Thermal printer AB1310/AB1310 Bluetooth